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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/046,325	10/19/2001	Keng-Ming Huang	13613-002001	2708
26161	7590	08/10/2005	EXAMINER	
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MINNEAPOLIS, MN 55440-1022			PAPER NUMBER	

2662

DATE MAILED: 08/10/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/046,325

Applicant(s)

HUANG ET AL.

Examiner

Mohammad S. Adhami

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 10/19/2001.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-8 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 6 is/are allowed.
- 6) ☒ Claim(s) 1-5, 7 and 8 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 19 October 2001 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Drawings

1. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they include the following reference character(s) not mentioned in the description: 540. Corrected drawing sheets in compliance with 37 CFR 1.121(d), or amendment to the specification to add the reference character(s) in the description in compliance with 37 CFR 1.121(b) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Objections

2. Claims 1,6, and 7 are objected to because of the following informalities: The word "trie" is incorrectly spelled. It will be assumed for examining purposes that the word "trie" is meant to be "tree". Appropriate correction is required.

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1-5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hariguchi (US App. No. 09/895,972) in view of Ji (US App. No. 10/032,379) and further in view of Brown (US 6,880,064).

Re claims 1 and 5:

[Claim 1] Hariguchi discloses several levels (Paragraph [0028] "the routing table arrays are arranged hierarchically in a plurality of levels"), where each level comprises "primary entries" (Paragraph [0028] "each routing table has a plurality of entries"), a pointer to the next level entries (Paragraph [0028] "a next level pointer to one of the routing tables in another level"), "a next hop index indicating the next hop address for the data packets" (Paragraph [0006] "the information in a route entry includes at least the following: a destination IP address...a next hop's IP address"), and a "second level index entries associatively addressable by a second field of address bits from the network address" (Paragraph [0028] "each routing table array is associated with a predetermined subset of prefixed of the IP address").

Hariguchi does not disclose memory storing a compression trie with levels comprising a compression bitmap with level index entries directly addressable by

a first field of bits from the network address of the data packets, addressing next level entries using previous level index, using a next level submodule when the current field of address bits is not sufficient to determine the next hop address, an independent and dependent index, which are respectively set to '1' and '0'.

[Claim 1] Ji discloses a memory storing a compression tree with a compression bitmap with level index entries directly addressable by a first field of bits from the network address of the data packets (Pg. 13 Claim 5 "a first lookup table having at least one entry, each of the at least one entry having a bitmap portion and an information storage portion...wherein the at least one entry in the first lookup table is indexable by a first portion of an IP destination address").

[Claim 1] Brown discloses addressing the next level entries using the previous level index and an independent index that corresponds to the next level entry and a dependent index that corresponds to the previous level index entry, where [Claim 5] an independent index is a bit '1' and a dependent index is a bit '0' (Col. 10 lines 1-5 "A data field...is set to '0' if the mapper entry for the previous node is to be used and set to '1' to increment to the next mapper entry address if the next mapper entry store in the subtree mapper...is to be used."), [Claim 1] alternating independent and dependent entries (Col. 7-8 lines 66-67, 1-2 "Each node in the binary tree is shown with two children, a right child and a left child. The right child is chosen if the parent node is '1'. The left child is chosen if the parent node is '0'"), and using a next level sub module when the current "field of address bits is not sufficient to determine the next hop address" (Col. 7 lines 38-

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43 "the pipeline allows multiple searches of the lookup unit...until a search of the other mappers has been completed, if required").

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Hariguchi to include a memory storing a compression trie table with levels comprising a compression bitmap with level index entries directly addressable by the first field of bits from the network address as taught by Ji in order to reduce the amount of memory required to store the network addresses.

It further would have been obvious to one of ordinary skill in the art at the time of the invention to modify Hariguchi in view of Ji to include addressing next level entries using a previous level index, using a next level submodule when the current field of bits is not sufficient to determine the next hop address, and have an independent and dependent index and alternating independent and dependent entries as taught by Brown in order to reduce the amount of redundant address calls.

Re claims 2 and 3:

Claims 2 and 3 are a redundant process of claim 1. The disclosures stated above can be applied for multiple levels, and thus each specific level described in the claims is not specifically addressed.

As discussed above, Hariguchi in view of Ji and further in view of Brown meets all the limitations of the claims except using five levels.

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Brown discloses using five levels (Col. 8 lines 22 "the route index for level_5 nodes").

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Hariguchi in view of Ji and further in view of Brown as stated in above to include five levels as taught by Brown in order to have an optimal memory arrangement (Brown Col. 6 lines 39-40 "appears to be optimal in the current memory technology").

Re claim 4:

Hariguchi discloses a forwarding table wherein the network address is an Internet Protocol (IP) address (Paragraph [0006] "In one routing table, the information in a route entry includes at least the following: a destination IP address").

3. Claims 7 and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hariguchi in view of Ji.

Re claim 7:

Hariguchi discloses a forwarding table lookup method for identifying a network address to determine a next hop address, with the table having multiple levels (Paragraph [0028] "a router having one or more ports for receiving a message having a destination address...the routing table arrays are arranged hierarchically in a plurality of levels"), retrieving a field of address bits corresponding to a level (Paragraph [0028] "each routing table array is

associated with a predetermined subset of prefixes of the IP address”), searching for a bit from the field of bits and obtaining a “next hop index” (Paragraph [0076] “The routing table...determines whether at least a portion of the destination address matches a stored address and supplies next hop information...based on a match...between at least a portion of the destination address and the stored address”), and retrieving a next field of address bits and searching for a next bit (Paragraph [0020] “The next eight bits of the destination address...are used to generate the index into the level 1 array”).

Hariguchi does not disclose a compression tree.

Ji discloses a memory storing a compression tree with a compression bitmap (Pg. 13 Claim 5 “a first lookup table having at least one entry, each of the at least one entry having a bitmap portion and an information storage portion”).

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Hariguchi to include a compression tree as taught by Ji in order to reduce the amount of memory required to store network addresses.

Re claim 8:

Hariguchi has a network address that is an Internet Protocol (IP) address (Paragraph [0009] “the router uses the destination IP address”).

Allowable Subject Matter

4. Claim 6 is allowed.

The prior art of record does not teach or fairly suggest an "IPv4 address forwarding table lookup apparatus for identifying a 32-bit Internet Protocol (IP) address to determine a next hop address to which data packets having the IP address should be forwarded" in which the apparatus has a memory storing a five-level compression tree with a first, second, third, and fourth level that are addressed by the 1st to 17th, 18th to 24th, 25th, 26th to 32nd bits respectively. The prior art of record also fails to teach or fairly suggest a first, second, third, and fourth level with 2, 128, 2, and 128 index entries respectively.

Conclusion

5. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Pavesi (US 6,549,536) discloses a compression bitmap and a tree search algorithm.


Any inquiry concerning this communication or earlier communications from the examiner should be directed to Mohammad S. Adhami whose telephone number is (571)272-8615. The examiner can normally be reached on Monday-Friday 8-4:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Hassan Kizou can be reached on (571)272-3088. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

MSA 8/3/2005


JOHN PEZZLO
PRIMARY EXAMINER